A survey of the distribution of the unarmed stick insect *Acanthoxyla inermis* in Port Gaverne and Port Isaac, North Cornwall in 1992.

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Phasmida, *Acanthoxyla inermis*, British stick insects, Cornwall, Port Gaverne, Port Isaac.

Introduction

I have great pleasure in introducing Malcolm Lee's excellent study on *Acanthoxyla inermis* in his area, the first records from the north Cornwall coast. Malcolm's study follows Eve Bysouth's detailed survey conducted on *A. geisovii* in the St Mawes area in the 1980s, and both are to be congratulated on their enthusiasm and enterprise in recording these insects and adding to our knowledge of their habits.

A fuller version of Malcolm's report, including notes on the status of individual colonies, a map and excellent photographs showing the differences between British stick insects has been sent to the relevant bodies in Cornwall. It is with regret that the disclosure of exact localities can cause problems. Tresco Abbey Gardens is the only known site for *Clitarchus hookeri* in Britain and whilst visiting the gardens in autumn 1992 the staff complained to me about individuals from outside the UK who left with bag-fulls of these insects. Whilst serious studies are to be encouraged, there is no justification for collecting on such a scale and it seems some form of conservation is needed if future visitors are to enjoy seeing these rare insects in Britain.

Finally I must refer to Professor Salmon's outstanding book *The Stick Insects of New Zealand* (1992) which downgrades various *Acanthoxyla* species to subspecies of *A. prasina* (Westwood). I have discussed this matter with Professor Valerio Scali who agrees with me that they appear to be distinct species. Salmon (personal correspondence, 1993) comments that 'nobody as yet has taken up the challenge by doing chromosome work on these insects in New Zealand'. The position will not be certain until such studies have been made. If one agrees with Salmon, the British species should be known as *A. prasina inermis* and *A. prasina geisovii*.

The survey

In August 1990, I photographed a brown stick insect in my garden here in Port Gaverne. At the time I thought little of it. My wife had seen one in 1988, and my mother had mentioned catching them in Devon in the 1920s, when she was a small girl, so I had assumed that they were common in the South West.

In Spring 1992, after showing the photos to our local National Trust warden, Simon Ford, I was contacted by Chris Haes, the National recorder for these insects. From the photos he was able to confirm that my insect was the unarmed stick insect *Acanthoxyla inermis* Salmon, and he explained that they have a very localised distribution in the South West.

Having had other local reports of stick insects, I decided to undertake a survey to try and establish how widespread they were, and how they had got here. Several articles in the local monthly magazine asking people to contact me if they found one or if they had information on earlier sightings were very successful, with 16 reports of sightings in 1992 and a further 14 relating to previous years. Before detailing the results of the survey, a summary of the fascinating story of the British stick insects will be of interest.

Three species of stick insect have established themselves in the wild in Britain: the spiny stick

insect *Acanthoxyla geisovii* (Kaup), the smooth stick insect *Clitarchus hookeri* (White), and the unarmed stick insect *A. inermis*. Coincidentally all are native to New Zealand. Almost certainly they arrived here on imported plants, either as insects or, more likely, as eggs.

The first stick insect to be identified was the spiny stick insect, located at Paignton in 1908, and Tresco, Isles of Scilly in 1943 (Uvarov 1944). The Scilly colony may be as old as the Paignton one, since a consignment of New Zealand tree ferns was imported onto Tresco in 1907 and some of these were sent to Paignton the same year. They are also established at a few locations around the Fal estuary in Cornwall, principally at St Mawes where Tresco insects were deliberately released in 1959, and at Torquay and Ivybridge in Devon.

The smooth stick insect was first recorded at Tresco in 1949 (Uvarov 1950), which is still the only confirmed UK location. "Smooth" stick insects had been reported from several mainland locations but following research by Paul Brock in 1987 on insects from several locations, it was shown that these were in fact the very similar unarmed stick insect.

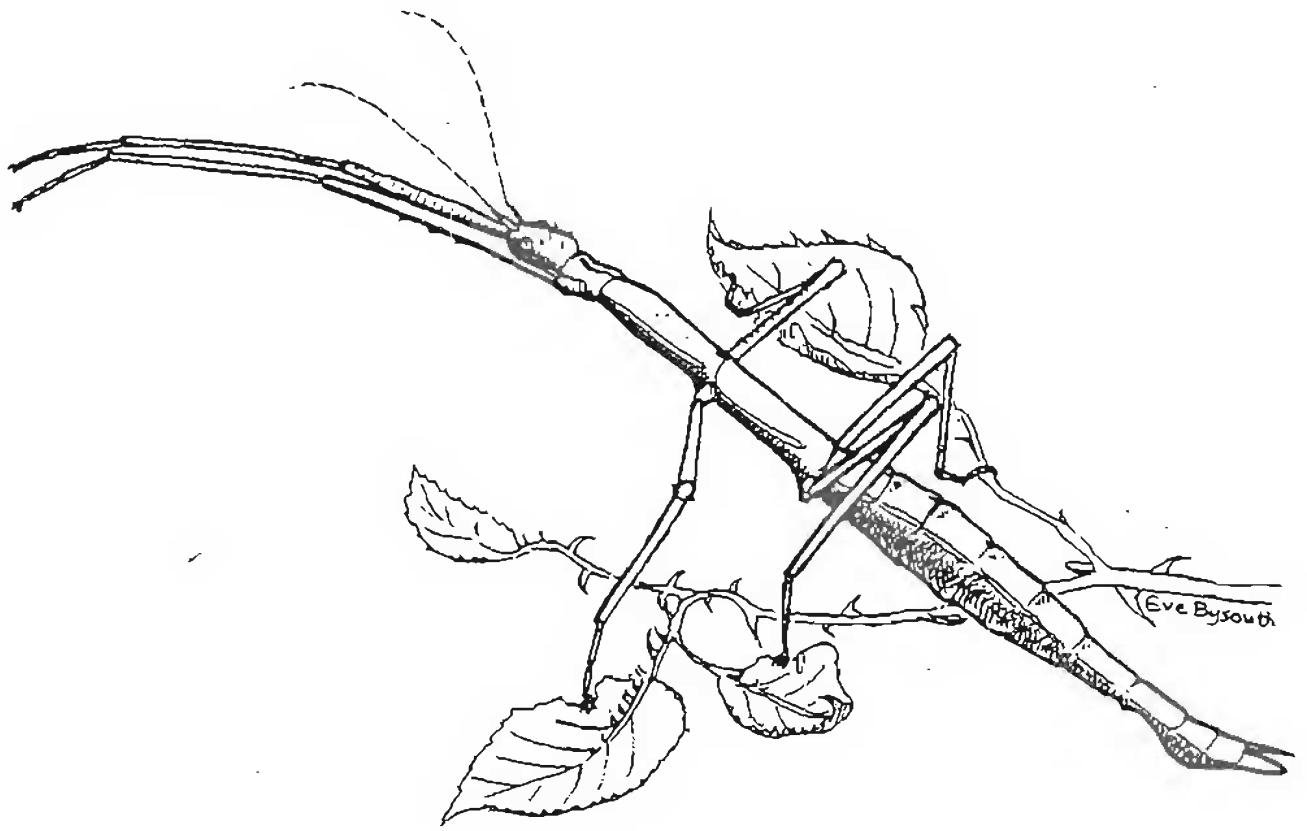

Figure 1. *Acanthoxyla inermis*, length 104mm.

The first mainland record for the unarmed stick insect was in Truro in 1979 but they have now been found at several locations, again mainly around the Fal estuary. There may have been more than one introduction, Scott's nursery in Merriot, Somerset and Treseder's in Truro both being likely sources. Treseder's was largely responsible for introducing tree ferns to Cornwall in late Victorian times (West Briton, 1987b). These exotic plants still flourish in many of our principal gardens. Neil Treseder, who retired from the family business in 1976, remembers seeing the insects at the nursery from his childhood days (West Briton 1987a). Further evidence for their long established status comes from the gardener at one location at Helford Passage, who reported seeing

them since the 1930s, when the garden was laid out with New Zealand tree ferns.

All three species can be either green or brown and have an adult body length typically within the range 85-105mm. Generally *A. inermis* are at the top end of this range and *C. hookeri* at the bottom. With numerous black spines over its body, *A. geisovii* is unmistakable. The absence of spines makes *C. hookeri* and *A. inermis* appear similar at first glance. They can be told apart since *C. hookeri* has a near continuous black line along its thorax, has pointed cerci and has no opercular spine, whereas *A. inermis* has a black line on the pronotum only, rounded cerci, and has a stout opercular spine.

Their life cycle is unusual. In Britain all the species breed parthenogenetically, that is, eggs develop without the need for fertilization by a male. Indeed, *Acanthoxyla* males are unknown, even in their native country; *C. hookeri* males are common in New Zealand, but none have been found here.

Date	Comments
04/92	Brown adult found on wall.
07/92	Green adult crawled onto school bag.
31/07/92	Brown adult found in hallway of house.
07/08/92	Green 67mm nymph found on wall. Owner of garden had disposed of insects in her garden some years ago and sees them most years.
15/08/92	125mm brown/purple mottled adult.
Mid/08/92	Green adult on wall.
20/08/92	Large colony of up to 20 adults.
Late/08/92	Several green adults seen on runner beans.
30/09/92	Green nymph about 70mm seen on bramble.
25/10/92	Olive adult on raspberry canes.
01/11/92	Large colony of 22 adults. Four green, three olive & 15 cherry red.
03/11/92	105mm brown/purple blotched adult on rear step. Large bramble which forms the garden hedge showed evidence of insect attack.
11/92	Garden adjacent to above. Adults often found on car bonnets in mornings.
06/11/92	Green 97mm adult found on wall
13/11/92	108mm green adult & 48mm brown nymph. Adult on bramble, nymph on red valerian.
15/12/92	Brown adult on handrail by garden steps.

Table 1. Records from Port Gaverne and Port Isaac in 1992.

The insects live for around six months, laying 200-300 eggs when they are adult. The eggs simply drop to the ground to hatch, mainly in late spring, into miniature versions of the adults, about 12mm long. They grow by shedding their skin and expanding before their new skin hardens. After five or six moults they become fully grown adults and, within a few weeks, start laying eggs. Most insects will die with the onset of cold weather, but it is possible that a few may survive

through very mild winters.

Of the insects seen by me during the survey, all were confirmed as *A. inermis*. The 16 reports of sightings in 1992 (Table 1) involved almost 60 insects, with two sites having around 20 insects each. The teachers at Port Isaac school also confirmed that further insects were found in upper Port Isaac and brought into school during 1992. It is clear that they are now widespread in gardens in upper Port Isaac and in Port Gaverne.

Adult insects were seen from April through to December (Table 1). The one seen in April may have overwintered, since my own weather records show that on only one night during the winter of December 1991 to March 1992 did the temperature fall to 0°C and the average daily minimum in January was 6°C. The peak times for sightings was, rather surprisingly, early November. This was more due to a strong gale removing leaves, thus rendering the insects more visible, rather than any increase in numbers.

The incredible camouflage of these insects undoubtedly leads to substantial under-recording of their presence. One resident who had expressed great interest in my survey, and had regularly visited one large colony, was amazed to find 22 insects in her own garden in November! They had clearly been overlooked for several months. This camouflage is totally ineffective when they are moving from plant to plant, which accounts for half of the reports being of insects on walls, windows, etc. One insect was even found in the house, where it had probably been brought in on a coat and had crawled off after the coat had been hung up.

Of those insects found on plants, the most common foodplant was bramble, but raspberry and rose were also favoured. Of the two large colonies, one was on bramble and the other on roses. One report was of insects on runner beans, although, when Paul Brock and I visited the garden, there was no evidence of feeding, so perhaps they were just passing through. A nymph was found on red valerian *Centranthus ruber*, on which it had been feeding.

Of 16 adults which were measured, almost 75% were in the range 94-99mm. Overall the average length was 99.3mm with the ten green insects having an average of 95.9mm and the six browns 104.8mm. This is a small sample but Eve Bysouth's 1985 (Bysouth 1990) survey of *A. geisovii* also showed browns were longer than greens. The real surprise of the survey was a huge brown/purple blotched 125mm insect found in Port Isaac. Apart from being the largest *A. inermis* recorded, it is also the longest insect ever found outdoors in the UK. Unfortunately, it died a short while after I received it. After death the insect shrank slightly to 120mm due to decrease in body fluid pressure. It is now in the collection of Paul Brock.

In mid November I located a 108mm green adult and a 48mm brown nymph at a site in Port Isaac. As they would not have survived much longer, I took them indoors for study. The adult had probably only just had its final moult, since it laid no eggs for two weeks and then went on to lay 250 eggs in 99 days before it stopped laying. By cleaning the cage daily I was able to record the number of eggs laid each day. Egg laying got off to a slow start and slowed down again at the end. The frequency distribution for the number of eggs laid per day is shown in Figures 2 and 3. Figure 2 shows results obtained over the 99 day egg laying period, Figure 3 shows the frequency distribution for the middle 69 days.

The overall mean was 2.52 eggs per day and the mean for the middle 200 eggs was 2.96 per day. At the time of writing, the brown insect has started laying eggs. It was noted that the eggs laid by

one insect all bore identical markings, but these differed from the markings on the other insect's eggs. This enabled those from the brown and green insect to be separated, even when they were laying concurrently. The brown insect is laying at a greater rate than the green one, with 113 eggs laid in the last 26 days, a mean of 4.36 eggs per day.

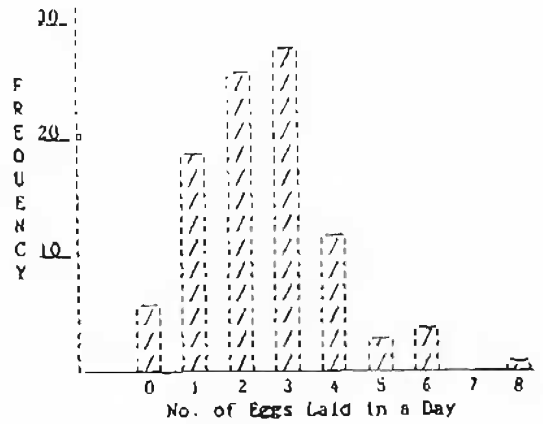

Figure 2. All 99 days.

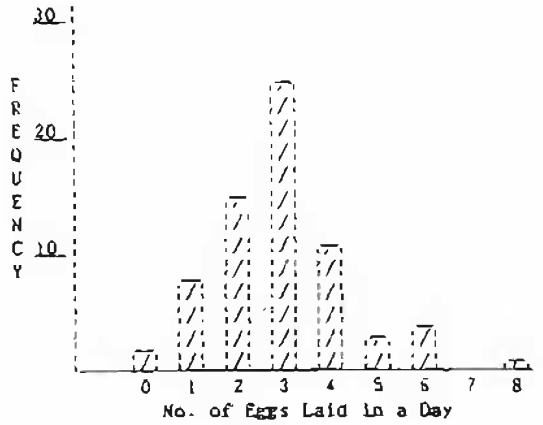

Figure 3. Middle 69 days.

The ambient temperature has a marked effect on egg laying. Initially the adult was in an unheated room with an ambient temperature of 13-15°C. When the temperature fell below 12°C egg laying became sporadic with only four eggs in seven days. When moved into a warm room with an ambient temperature range of 15.5-18°C egg laying immediately increased to 19 eggs in seven days. Outdoors, the onset of cold weather means that wild insects will lay far fewer eggs in their lifetime than captive specimens. Insects which do not become adult before the end of September may die before they lay any eggs.

Before this survey I had rarely seen stick insects so I was surprised to see the wide variations in colour of brown insects, and their ability to change colour, sometimes in a matter of minutes. Green insects did not show this ability, remaining a uniform apple green with a thin yellow line along the side of the thorax. Brown forms seen by me have varied from olive, light straw, mahogany red to brown/purple blotched, and shades in between.

The first time I noticed the ability to change colour was the huge insect from Port Isaac. The opercular spine was pale yellow when first observed, but less than an hour later, it had turned deep pink. The following morning the insect was quite pale but within ten minutes of opening the curtains it had gone back to dark purple mottling. The brown nymph I collected in November was very pale, but the following morning had become much darker. It has a regular daily cycle of colour changes, becoming pale at night and is now a mahogany red during the day.

Presumably this ability to change colour is to improve its already superb camouflage. Perhaps it is also related to the plants on which it feeds. It was noticeable that the browns in the large colony on bramble were all dark straw which was a perfect match for the old stems. The browns in the large colony on roses were all red/brown which was a perfect match for autumn rose stems. Whilst the number of browns found during the survey was just over half of the total, they accounted for over 80% of those on roses but only 33% of those on brambles.

It may be that most brown insects start out as green. In 1982 Mrs Watts of Penryn raised 400 *A. inermis* from eggs. Only three were brown and they were sickly and died before maturity (Turk 1985). In 1985 Eve Bysouth kept eggs from green, olive and brown *A. geisovii* separate but all

the offspring were green (Bysouth 1990).

My 48mm brown nymph found on 13th November had three moults before becoming adult. The dates of moult and body length are shown in Table 2. Egg laying began on 11th February, 14 days after becoming adult.

Date	Length	Increase in length	Days between moults
26-11-1992	62mm	29%	-
08-01-1993	84mm	35%	43
28-01-1993	106mm	26%	20

Table 2. Moulting data for the brown nymph.

Insects have been seen in Port Gaverne and Port Isaac for some years (Table 3). One of the first reports in 1992 was from a lady who told me that she used to work at Port Isaac school and had tipped out some stick insects in her garden at the end of term about ten years ago. She had thought they were dead, but has seen them most years ever since. The insects she tipped out were almost certainly dead, but she probably tipped out several hundred eggs at the same time. I subsequently spoke to Mrs Oaten who taught at the school in the early 1980s. She remembers getting insects in 1983 from another school, probably Wadebridge, which had surplus stock. It seems most likely that these first Port Isaac insects were the offspring of the 400 *A. inermis* bred by Mrs Watts in 1982; she has confirmed that many of those were given away to schools and other interested parties in the county (Turk 1985).

Date	Comments
1983	Insects acquired by school. Dead insects tipped out into private garden at end of term.
1987	Many insects in front hedge in June.
1988	Brown adult in garden in September.
1990	Brown adult in garden in summer.
1990	Brown adult on rose in garden.
1990	Many insects found in September when clearing bramble from overgrown garden.
1990	Insect seen on window in October.
1990	Green insect seen on wall in autumn.
1991	Green & brown insects seen in garden in summer.
1991	Children found one in summer while waiting for school bus.
1991	Seen on rose in garden in autumn.
1991	Green insect on bramble beside footpath.
1991	Brown insect in garden in December.
1991	On garden wall in December.

Table 3. Records from Port Gaverne and Port Isaac prior to 1992.

It is possible that other school insects from the 1982 source may have been accidentally introduced into the wild in Cornwall. The teacher at Blisland school, a few miles inland from here, advised me that the children found stick insects outdoors in the school nature garden in 1992. Stick insects without spines were also reported from a garden in St Ives, Cornwall, in 1990. Undoubtedly other sites will turn up.

In the ten years since their accidental release, the Port Isaac insects have spread only a few hundred metres from their original site. Although normally motionless, these insects can move surprisingly fast and could probably walk this distance in a single night. It seems likely that without the need to search for a mate, and given a sufficient food source, they have little inclination to move from their own bush.

Port Isaac has an equitable climate for these insects, very similar to their native New Zealand, with cool moist summers and frost free winters. Stick insect eggs however can clearly survive lengthy periods of frost. The hard winter of early 1987 brought several weeks of extremely low temperatures to Cornwall and the Scilly Isles. This caused severe frost damage to the sub-tropical gardens at Tresco, but that autumn both *C. hookeri* and *A. geisovii* were found by Paul Brock when he visited the gardens.

On 23rd March 1993, a very active 98mm green adult was found sunning itself on a wall in Port Isaac. My weather records show this winter was even milder than 1992, with the lowest temperature 3°C and an average January minimum of 9°C. Whilst the important factor for the species survival from year to year remains with the eggs, this is the first confirmation of a stick insect living through a mild winter.

The prospect for our stick insect colony is very good. Their widespread distribution in so many gardens means that any accidental spraying of one site with garden insecticide will not be catastrophic. The most heartening sign for the future wellbeing however is the attitude of those residents in whose gardens the insects were staying. Almost without exception they were delighted to share their garden with these fascinating insects. A few nibbled leaves on the roses was generally regarded as a small price to pay for the pleasure of observing these inoffensive creatures.

Acknowledgements

I am grateful to Eve Bysouth for permission to use her fine *A. inermis* drawing in my local monthly magazine articles. Without this illustration the response would have been much diminished. I am also grateful to Stella Turk at CBRU for supplying me with copies of the two Uvarov papers (1944, 1950). My most particular thanks go to Paul Brock, Membership Secretary of the Phasmid Study Group, for providing me with copies of articles, newspaper cuttings, and his own unpublished data on British stick insects, and for bringing me specimens of *C. hookeri* and *A. geisovii* in order that I may photograph them.

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Editorial note

In the interests of conservation, references to specific localities which were in Malcolm Lee's original manuscript have been omitted.